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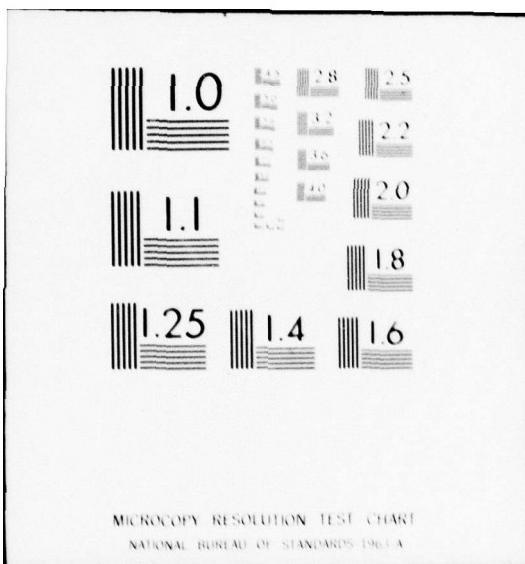
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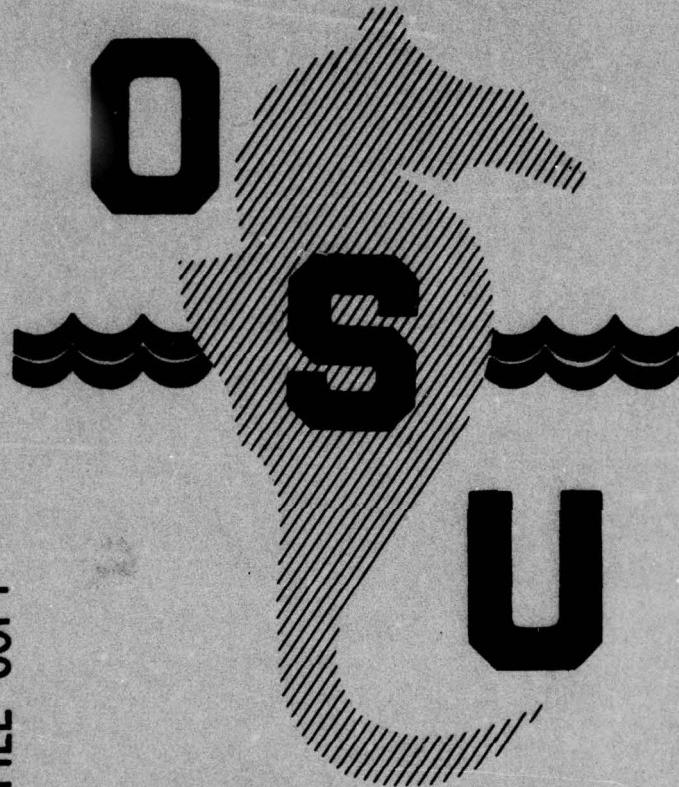
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Hydrographic and Chemical Data  
from the Eastern Tropical North  
Pacific Ocean—January 1977

by

Yuval Cohen  
Marvin D. Lilley  
Louis I. Gordon

Office of Naval Research  
Contract N00014-76-C-0067  
NR 083-102

Reference 78-5

March 1978

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REPORT DOCUMENTATION PAGE			READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 78-5	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) HYDROGRAPHIC AND CHEMICAL DATA FROM THE EASTERN TROPICAL NORTH PACIFIC OCEAN - January 1977.		5. TYPE OF REPORT & PERIOD COVERED Technical Rept's January 1977	
6. AUTHOR(s) ⑩ Yuval Cohen, Marvin D. Lilley Louis I. Gordon		7. CONTRACT OR GRANT NUMBER(s) ⑪ N00014-76-C-0067 ✓	
8. PERFORMING ORGANIZATION NAME AND ADDRESS School of Oceanography Oregon State University Corvallis, OR 97331		9. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 083-102	
10. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research Ocean Science & Technology Division Arlington, VA 22217		11. REPORT DATE ⑫ March 1978	
12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 25	
14. DISTRIBUTION STATEMENT (of this Report)		15. SECURITY CLASS. (of this report) Unclassified	
Approved for public release; distribution unlimited		16. DECLASSIFICATION/DOWNGRADING SCHEDULE	
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) ⑭ GREF-78-5		18. SUPPLEMENTARY NOTES 185 TRAC	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) 1. Hydrographic data      6. Eastern Tropical North Pacific Ocean 2. Chemical data 3. Nitrous oxide 4. Nutrients 5. Denitrification			
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents hydrographic and chemical data from the eastern tropical North Pacific Ocean collected in January 1977 aboard Oregon State University's (OSU) R/V WECOMA during Leg I of Cruise WELOC 77. The purpose of the cruise, WELOC-77-I, was to investigate the distributions of dissolved nitrous oxide and molecular hydrogen in an oceanic environment characterized by an extensive oxygen minimum layer which is thought to be the major denitrification site in the world ocean. Accordingly, the research effort			

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*CONT* → was concentrated on studying the distributions of variables at stations located around the core of the oxygen minimum.

Some of the data presented in this report have been discussed in the following publications:

- Y. Cohen (1977) Shipboard measurement of dissolved nitrous oxide in seawater by electron capture gas chromatography. *Anal. Chem.* 49(8): 1238-1420.
- Y. Cohen and L.I. Gordon (1978) Nitrous oxide in the oxygen minimum of the eastern tropical North Pacific: evidence for its consumption during denitrification and possible mechanisms for its production. *Deep-Sea Res., In Press.*

<sup>1</sup> The hydrogen data will be submitted in a later data report.

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OREGON STATE UNIVERSITY  
Corvallis, Oregon 97331

HYDROGRAPHIC AND CHEMICAL DATA FROM THE  
EASTERN TROPICAL NORTH PACIFIC OCEAN - JANUARY 1977

Yuval Cohen  
Marvin D. Lilley  
Louis I. Gordon

Office of Naval Research  
Contract N00014-76-C-0067  
Project NR 083-102

Reference 78-5  
March 1978

George H. Keller  
Acting Dean

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## INTRODUCTION

This report presents hydrographic and chemical data from the eastern tropical North Pacific Ocean collected in January 1977 aboard Oregon State University's (OSU) R/V WECOMA during Leg I of Cruise WELOC 77. The purpose of the cruise, WELOC-77-I, was to investigate the distributions of dissolved nitrous oxide and molecular hydrogen<sup>1</sup> in an oceanic environment characterized by an extensive oxygen minimum layer which is thought to be the major denitrification site in the world ocean (e.g. Codispoti and Richards, 1976; Cline and Kaplan, 1975). Accordingly, the research effort was concentrated on studying the distributions of variables at stations located around the core of the oxygen minimum.

Some of the data presented in this report have been discussed in the following publications:

- Y. Cohen (1977) Shipboard measurement of dissolved nitrous oxide in seawater by electron capture gas chromatography. *Anal. Chem.* 49(8): 1238-1240.
- Y. Cohen and L.I. Gordon (1978) Nitrous oxide in the oxygen minimum of the eastern tropical North Pacific: evidence for its consumption during denitrification and possible mechanisms for its production. *Deep-Sea Res., In Press.*

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<sup>1</sup> The hydrogen data will be submitted in a later data report.

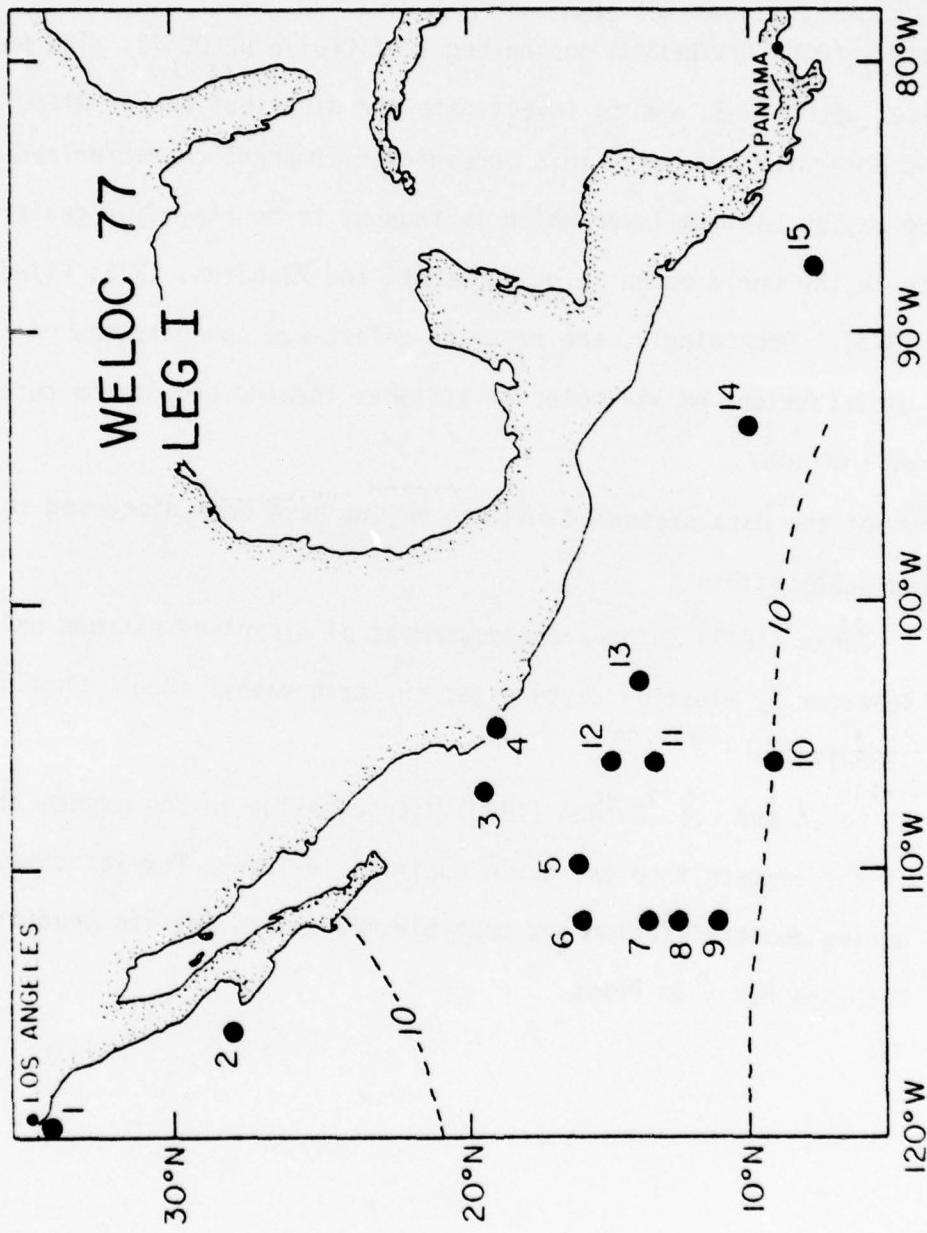


Figure 1. Station locations for Cruise WELOC-77-I. The dashed line delineates the region where intermediate waters contain less than  $10 \mu\text{mol O}_2 \text{ l}^{-1}$  as determined by the Winkler procedure.

## METHODS

### Sampling

Station locations for Cruise WELOC-77-I are shown in Figure 1. Samples were collected primarily in 5- and 30-liter PVC bottles designed and constructed at OSU (Mesecar, 1976) but at some stations one liter NIO bottles were used. All samples were processed onboard. Therefore, the sampling intervals at a given station were selected on the basis of the data collected at the near-by previously occupied stations.

### Analytical Procedures

Temperature was measured with reversing thermometers calibrated at OSU.

Salinity was determined using a Guildline Autosal Model No. 8400 salinometer with an average precision of 0.01%. (All the reported precisions are one relative standard deviation of replicate sample measurements.)

Dissolved oxygen was determined using Carpenter's (1965) modification of the Winkler procedure with 0.3% precision at the deep water levels. The method is accurate to about 0.5% at normal oceanic oxygen levels but its accuracy might be quite poor at the low oxygen levels around the core of the eastern Pacific oxygen minimum (Broenkow and Cline, 1969).

Nutrients were measured with the OSU AutoAnalyzer II system (Gordon et al., 1975). Precisions and estimated accuracies at the deep water levels were 0.2% and 2%, respectively, for silicate, 0.4% and 2%, respectively, for phosphate, 0.5% and 2%, respectively, for nitrate and 0.5% and 5%, respectively, for nitrite.

Dissolved nitrous oxide was measured using electron capture gas chromatography (Cohen, 1977) with 2% precision and an estimated accuracy of 3%. The same method was used for measurements of nitrous oxide in air sam-

ples. The average atmospheric nitrous oxide content determined from 16 samples of marine air taken during the cruise was  $287 \pm 9$  ppbv (3.1%, one relative standard deviation). The atmospheric N<sub>2</sub>O content showed no systematic variations with respect to geographic location along the cruise track.

#### CRUISE PARTICIPANTS

Marvin Lilley	OSU
Yuval Cohen	OSU
Wayne Dickinson	OSU
David Standley	OSU
James Mitchell	OSU
Gary Johnson	OSU
George O'Masta, Jr.	OSU
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Becky McClurken	Corvallis, Oregon
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Ernesto Reynoso	School of Marine Science, Ensenada, Baja California, Mexico
William VanRy	Seattle, Washington

#### ACKNOWLEDGMENTS

Cruise WELOC-77-I was funded by the Office of Naval Research through Contract N00014-76-C-0067 under Project NR 083-102. We greatly appreciate the assistance of the officers, crew and scientific party aboard R/V WECOMA.

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- Broenkow, W.W. and J.D. Cline (1969) Colorimetric determination of dissolved oxygen in low concentrations. Limnol. Oceanog., 74, 450-454.
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- Mesecar, R. (1976) A positive seal water bottle. Exposure, 4, 1-5.

## DATA LISTING

The following notations are used in the data listing:

Z	Depths in meters
T	Temperature in degrees Celcius
POT T	Potential temperature in degrees Celcius
S	Salinity in per mil
O2	Dissolved oxygen concentration in micro-moles per liter
SIL	Silicate concentration in micro-moles per liter
P04	Phosphate concentration in micr-moles per liter
N03	Nitrate concentration in micro-moles per liter
N02	Nitrite concentration in micro-moles per liter
N20	Dissolved nitrous oxide concentration in nanno-moles per liter

A summary of weather conditions during the cruise (Table 1) follows the Data Listing, page 25.

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STATION NUMBER	T	POL	34	10.24	120	13.54	N20	(NM/L)
(m)	(C)	(C)	SIGMA	02	SIL	PCU	N03	
1	14.580	14.530	33.656	25.047	26.7	0	.52	.52
10	14.551	14.551	33.679	25.070	26.7	0	.52	.52
25	14.380				26.4		.52	.52
49	12.690	12.693	32.566	25.0443	20.5	9.1	9.5	9.5
74	11.420				19.0	11.3	14.2	14.2
98					17.6	14.7	17.2	17.2

Date: 1/12/77 Messenger Time: 1345

Bottom Depth: 256 m

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(W)	(D)	(C)	(0/00)	THETA	---(MM/L)---						(NM/L)	
					28	ON	115	MW	02	SIL	POL	
1	17.740	17.740	33.949	24.552	246	•4	•36	0	•02	7.29		
10	17.730	17.728	33.947	24.553	246	•4	•36	•1	•02	7.27		
20	17.640	17.637	33.954	24.590	247	•3	•36	•1	•01			
30	17.510	17.605	33.949	24.584	245	•6	•37	•1	•02			
50	17.430	17.421	33.939	24.621	246	•5	•37	•1	•02	7.54		
75	16.380	14.369	33.525	24.994		1.5	•50	•7	•16			
100	12.650	12.636	33.634	25.427	206	7.6	1.04	9.8	•03	12.15		
150	11.700	11.681	34.133	25.996	107	22.0	2.02	22.5	•02			
200	10.720	10.695	34.325	26.325	57	32.2	2.49	27.3	•03			
249	9.580				44							
299	9.230	9.197	34.377	26.619	40							
407	7.600	7.559	34.339	26.340		57.3	2.94	35.7	•02			
499				34.360		67.5	3.18	39.5	•02			
607	5.870				15							
708	5.290	5.230	34.409	27.202	11	91.7	3.40	43.5	•02			
776	4.810	4.746	34.442	27.294	13	100.7	3.36	44.5	•02			
384	4.130	4.053	34.494	27.393		114.1	3.37	45.8	•02			
1443	3.000	2.895	34.575	27.579	49							
1945	2.270	2.140	34.624	27.632	75	157.3	3.12	43.0	•02			

Date: 1/14/77

Messenger Time: 1653

Bottom Depth: 4718 m

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STATION NUMBER	3			4			5			6			7			
	Z	T	POT T	S	SIGMA	SIGMA	S	SIGMA	SIGMA	S	SIGMA	SIGMA	S	SIGMA	SIGMA	
(#)	(Z)	(G)	(POT)	(S/00)	THETA	(U/W/L)										
1	25.160	25.150	34.360	22.632	20.9	• 2	• 34	• 6	• 34	• 6	• 34	• 6	• 34	• 6	• 34	• 6
50	23.410	22.394	34.510	23.462	13	2.3	• 79	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
99	14.400	14.365	34.633	25.850	16	24.0	2.58	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9
149	12.840	12.812	34.306	26.234	5	29.9	2.72	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4
198	12.040	12.014	34.917	26.454	2	53.3	2.73	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5
265	11.300	11.266	34.761	26.561	2	37.1	2.52	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9
298	10.740	10.703	34.725	26.635	2	39.3	2.84	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
357	10.110	10.067	34.374	26.796	5	45.5	3.04	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2
394	9.390	9.355	34.265	26.823	2	51.3	3.05	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
442	8.760	8.710	34.602	26.973	2	57.1	3.17	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
504	8.160	8.106	34.574	26.942	2	61.2	3.20	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
566	7.550	7.442	34.552	27.025	3	63.9	3.24	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
609	7.020	6.960	34.540	27.094	3	76.9	3.32	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
794	5.460	5.372	34.526	27.260	6	93.0	3.42	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2
1001	4.430	4.394	34.551	27.404	2	110.0	3.55	46.2	46.2	46.2	46.2	46.2	46.2	46.2	46.2	46.2
1618	3.210	3.092	34.575	27.502	25	125.7	3.47	46.2	46.2	46.2	46.2	46.2	46.2	46.2	46.2	46.2

Date: 1/16/77

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STATION NWW3E2		4	19	10.2N	134	22.2W			
Z	T	POT T	S	SIGMA	O2	SIL	PO2	N03	NO2
(m)	(°C)	(C)	(0/00)	THETA					
1	26.930	26.930	34.129	22.139	.1	.50	0	.03	
10	26.920	26.920	34.180	22.170	.1	.30	0	.03	
30	25.970	25.963	34.175	22.445	1.92	1.7	.55	3.1	.13
60	19.830	19.819	34.560	24.494	54	12.9	1.93	22.9	.08
80	16.930	16.917	34.694	25.313	22	19.0	2.33	27.7	.09

Date: 1/17/77

Messenger Time: 0917

Bottom Depth: 106 m

STATION NUMBER	S	16	1.0N	140	1.0W	(UW/L)			N20 (NM/L)
						T	PJT T	S	
(H)	(C)	(C)	(C/JD)	THETA					
1	25.950	25.950	33.047	21.601	207	0	.2F	.1	.04
10	26.200				210	0	.2F	.1	.01
25	26.290	26.264	33.0344	22.171	202				6.025
50	26.120	26.108	33.0374	22.550	205				7.39
60	25.640				0	.41	.5	.5	
75	23.250	23.234	34.0414	23.0444	170	1.3	.78	5.1	.66
100	16.430	16.414	34.0462	25.0258	63	13.2	1.97	22.4	.05
149	13.160	13.139	34.0716	26.164	6	27.1	2.65	29.0	.03
199	11.890	11.864	34.0743	26.435	4	31.7	2.71	27.6	1.93
258	11.040	11.007	34.0770	26.567	3	35.3	2.76	28.6	.01
304	10.310	10.273	34.0772	26.669	5	40.0	2.84	26.9	2.04
387	9.100	9.056	34.0592	26.810	2	47.2	2.97	34.7	.02
506	7.730	7.679	34.0545	26.945	4	60.0	3.15	33.5	.02
569	7.2F0	7.203	34.0543	27.052	9	66.8	3.22	39.5	.02
598	7.040	6.991	34.0540	27.0981	3	72.2	3.30	40.3	.02
913	5.450	5.379	34.0543	27.291	5	91.9	3.44	46.1	.03
1002	4.570	4.498	34.0552	27.490	13	107.4	3.68	47.7	.03
1340	3.850	3.744	34.0569	27.492	23	122.9	3.41	47.3	.03
									26.39

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Date: 1/18/77

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STATION NUMBER	Z	T	PJT T	S	SIGMA	02	SIL	PO4	NO3	NO2	N2O	1W	
												(M)	(C)
1	26.420	26.420	33.315	21.658	211	0	.25	0	0.1	0.01	5.97		
25	26.530	26.524	33.705	21.916	211	0	.25	0	0.01	0.01	5.68		
50	26.510	26.592	33.732	21.963	209	0	.25	0	0.02	0.02	5.86		
75	26.110	26.092	36.298	22.498	205	.2	.33	.5	.17	.17	3.10		
100	19.630	19.911	34.506	24.455	36	9.6	1.67	18.6	.10	.10	28.57		
125	15.940	15.920	34.034	25.504	26	19.0	2.35	26.3	.06	.06	37.52		
150	13.510	13.588	34.779	26.121	15	25.8	2.62	26.0	1.60	1.60	7.60		
175	12.510	12.486	34.810	26.367	5	28.4	2.62	26.3	3.61	3.61	5.74		
198	12.120	12.093	34.795	26.431	3	29.6	2.64	27.3	3.24	3.24	5.25		
227	11.730	11.700	34.782	26.496	5	30.9	2.65	28.0	2.73	2.73	5.86		
248	11.520	11.498	34.769	26.526	+	31.6	2.65	28.5	2.60	2.60	6.24		
342	10.400	10.356	34.719	26.631	2	34.5	2.75	29.5	1.79	1.79	11.19		
405	9.520	9.473	34.650	26.733	3	44.3	2.96	29.5	.79	.79	5.31		
514	8.160	3.105	34.598	26.963	+	56.5	3.19	32.1	.60	.60	3.21		
605	7.180	7.120	34.561	27.078	1	56.1	3.28	38.1	.02	.02	19.45		
796	5.650	5.579	34.532	27.257	6	84.6	3.41	46.3	.02	.02	30.35		
999	4.700	4.617	34.553	27.397	1	99.8	3.42	47.3	.02	.02	28.66		
1908	2.100	1.976	34.644	27.711	9	150.9	2.99	42.5	.02	.02	18.66		
2744	1.760	1.559	34.674	27.766	11	150.9	2.98	42.3	.02				

Date: 1/19/77

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Bottom Depth: 3100 m

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STATION NUMBER			7	14	ON	111 52.5W			N20		
(M)	T	POT 1	S	SIGMA	C2	SIL	POL	NOS	N22	(NM/L)	
			(0/00)	THETA	(UM/L)						
0	26.920	26.820	33.091	21.362	20.9	0	.24	0	.02	6.91	
25			33.094		20.9	0	.22	0	.02		
50	26.280	26.262	33.0428	21.732	19.0	.1	.42	2.4	.23	10.79	
75	17.970	17.957	34.596	24.993	37	15.3	2.22	27.2	.10	36.67	
100	14.340	14.325	34.0761	25.0553	3	23.6	2.58	29.5	.06	42.37	
123	13.120	13.103	34.0924	26.0255	7	25.8	2.56	32.0	.06	33.33	
150			34.0916		2	28.0	2.53	32.6	.20	30.12	
175	11.490	11.357	34.0797	26.472	6	30.1	2.57	32.2	.30		
221	11.450	11.421	34.0731	26.547	2	32.3	2.63	31.1	.85	21.33	
254	10.860	10.828	34.0733	26.618	3	36.1	2.74	27.6	2.34	9.20	
300	10.210	10.174	34.0676	26.639	12	39.7	2.92	29.8	1.44	12.53	
393	9.760	9.737	34.0600	26.957	3	52.8	3.07	33.8	.03	21.82	
504	7.830	7.778	34.0546	26.971	6	59.5	3.19	27.0	.02	26.42	
611	6.780	6.721	34.0539	27.115	3	71.4	3.33	40.6	.02		
900			34.0552		6	89.0	3.48	45.8	.03		
1002	4.470	4.356	34.0563	27.0420	17	107.3	3.49	47.2	.02		
1504	5.070	2.952	34.0611	27.0601	57	139.4	3.26	45.3	.02		
1997	2.220	2.079	34.0650	27.0707	95	153.9	3.01	42.2	.02		
2514	1.960	1.679	34.0681	27.0763	111	166.4	2.90	40.7	.02		

Date: 1/20/77

Messenger Time: 1446

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STATION NUMBER	S	12 31.7N	111 51.3W	----- (UW/L) -----				NO2	NO3	PO4	SIL	SIGMA	SIGMA	T	T	PHT	(MM/L)
				(M)	(C)	(C)	(0/00)	THETA									
0	27.0220	27.0220	34.525	22.312	214	9	.25	.1	.02	.02	6.13						
24			34.529		203	0	.24	.1	.03	.03	6.10						
49	24.0540	24.0525	34.401	23.355	154						17.32						
73	17.0200	17.188	34.911	25.420	32	15.8	2.28	26.5	.29	.29	34.83						
97	14.0260	14.246	34.938	26.106	3	24.6	2.63	29.4	.05	.05	39.21						
122	12.0390	12.973	34.952	26.390	6	27.1	2.63	31.6	.03	.03	34.51						
146			34.953		5	26.7	2.57	34.2	.04	.04	37.35						
171	11.0310	11.737	34.949	26.609	10	28.6	2.39	33.5	.04								
195	11.0390	11.365	34.944	26.684	9	29.7	2.59	34.7	.03	.03	32.85						
219			34.940		9	31.1	2.62	34.3	.03	.03	27.74						
249	10.0920	10.889	34.939	26.768	11	31.3	2.57	35.7	.03	.03	30.09						
292	10.0510	10.474	34.937	26.837	15	33.7	2.66	35.6	.03	.03	27.29						
379	9.0450	9.406	34.916	27.006	2	43.4	2.92	35.0	.12	.12	26.73						
506	8.0260	9.296	34.903	27.197	3	53.2	3.09	37.2	.02	.02	25.19						
596	7.0260	7.200	34.93	27.327	3	64.7	3.25	39.6	.03	.03	25.12						
780			34.892		6	92.2	3.39	46.2	.03	.03	28.47						
987	6.0770	6.637	34.892	27.643	20	98.4	3.39	47.2	.03	.03	24.22						
1490	3.0220	3.107	34.903	27.825	60	131.5	3.21	45.0	.02	.02	21.29						
1998	2.310																
2494	1.0450	1.570	34.920	27.955	112	152.2	2.88	41.0	.03	.03	16.45						

Date: 1/21/77

Messenger Time: 1320

Bottom Depth: 3290 m

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STATION NUMBER	S	10 45.1N	111 52.3W	N20							
7	POT T	S	SIGMA	N2							
(W)	(C)	(G)	THETA	(NM/L)							
0	27.0210	27.0210	33.0142	21.0276	20.2	0	.19	.1	0	0	6.34
25			33.141		20.3	0	.19	.1	0	0	
50	24.0310	24.0390	33.0971	22.0617	15.5	2.7	.93	.9.1	1.0	1.0	15.84
75	17.0200	17.0077	33.0632	24.0527	21	17.6	2.41	29.8	.19	.02	
100	14.0300	14.0285	34.0795	25.0987	5	23.2	2.57	32.4	.03	.03	41.52
125			34.0323		5	26.9	2.53	34.8	.02	.02	
149	12.0290	12.0260	34.0519	26.0413	7	27.5	2.57	34.8	.03	.03	35.98
174	12.0360	12.0317	34.0311	26.0454	10	27.9	2.52	34.8	.03	.03	
198			34.0791		9	29.9	2.55	35.0	.02	.02	33.91
233	11.0250	11.0370	34.0774	26.0551	31.3	2.39	33.8	.05	.05	.05	
248	13.0340	13.0309	34.0703	26.0649	14	31.9	2.56	35.0	.02	.02	30.77
213	17.0580	17.0542	34.0738	26.0673	17	34.1	2.63	35.6	.02	.02	32.43
393	9.0550	9.0504	34.0675	26.0802	6	43.6	2.90	35.6	.02	.02	29.69
497	8.0380	8.0326	34.0615	26.0943	4	52.9	3.11	36.2	.16	.16	28.32
616	6.0270	6.0270	34.0574	27.0123	67.7	3.32	44.5	.02	.02	.02	29.15
704			34.0563		11	45.4	3.47	47.3	.02	.02	29.54
1009	4.0200	4.0517	34.0568	27.0410	33	101.8	3.41	47.1	.02	.02	25.85
1496	3.0170	3.0054	34.0604	27.0589	61	132.8	3.21	44.9	.01	.01	21.54
2014	2.0230	2.0066	34.0659	27.0713	92	155.4	3.01	42.9	.02	.02	13.50
2555	1.0250	1.0669	34.0677	27.0761	113	163.9	2.89	41.0	.01	.01	16.10

Date: 1/22/77

Messenger Time: 1316

Bottom Depth: 3750 m

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STATION NUMBER	T	FCT T	S	SIGMA	02	SIL	POL	N03	N02	N20
(W)	(C)	(C)	(C/03)	THETA	(UW/L)					(NM/L)
0	27.000	27.000	33.170	21.370	20.9	.6	.25	0	.00	6.077
50	20.570	20.560	34.045	24.226	.87	4.0.9	1.71	20.2	.46	25.71
100	13.160	13.146	34.0430	26.251	6	24.05	2.0FL	33.0	.03	36.92
150	11.960	11.960	34.0507	26.466	22	20.2	2.57	34.4	.02	
198	11.330	11.305	34.0775	26.556	13	28.02	2.40	34.0	.03	32.49
266	10.770	10.737	34.0766	26.660	30	30.5	2.41	34.0	.28	
296	10.180	10.144	34.0717	26.726	11	35.0	2.71	35.6	.04	29.05
348	9.500	9.560	34.0579	26.796	13	41.07	2.03	33.8	.03	27.15
397	9.790	9.746	34.0639	26.896	3	48.09	3.17	34.6	.03	27.05
445			34.0523		2	54.00	3.1F	36.3	.02	27.21
490	7.0730	7.0670	34.0602	27.030	55.0+	3.24	35.0	.02	29.12	
545			34.0591		3	65.0	3.32	40.5	.03	26.14
595	6.0730	6.0672	34.0574	27.150	3	69.01	3.35	42.02	.03	30.44
650	5.0240	5.0219	34.0575	27.211	1+	73.07	3.34	43.08	.03	
695	5.0320	5.0367	34.0566	27.249	7	79.02	3.41	45.08	.02	30.59
794	5.0420	5.0351	34.0576	27.322	14	94.09	3.42	46.5	.02	27.90
1001	4.0390	4.0309	34.0579	27.441	33	103.09	3.40	46.3	.03	27.02

Date: 1/24/77

Messenger Time: 0903

Bottom Depth: 3199 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

(m)	(C)	(C/000)	THETA	13 56.0N				105 59.5W				(NM/L)
				SIGMA	02	SIL	POL	N03	N02	N20		
0	27.0270	27.0270	33.0245	21.364	.2	.23	0	0	0	0	5.018	
50	27.030	27.016	33.0299	21.455	20.8	0	.24	0	0	0	6.044	
75	22.730	22.714	34.36-	23.555	12.5	17.2	1.20	12.1	.55			
100	16.770	16.753	34.694	25.357	16	17.2	2.44	30.0	.08	38.072		
125	13.0370	13.052	34.770	26.030	13	23.3	2.59	30.6	.12			
150			34.817		4	25.5	2.61	32.8	.03	35.077		
200	12.000	11.973	34.901	26.459	2	28.3	2.65	32.6	.21	27.641		
260	11.330	11.336	34.771	26.555	3	30.9	2.67	33.4	.03	26.657		
307	10.590	10.652	34.753	26.665	4	34.6	2.74	30.6	2.21			
400			34.650		3	43.1	2.97	32.6	.71	13.01		
515	9.170	9.115	34.622	26.791	11					16.91		
600	6.990	6.931	34.566	27.108	4	69.0	3.34	38.6	.02	19.41		
801	5.660	5.588	34.564	27.292	3	96.0	3.48	44.9	.02	30.42		
1014	4.570	4.466	34.564	27.413	13	104.5	3.54	44.7	.02			
1506	2.960	2.879	34.624	27.618	56	134.4	3.28	45.2	.64			
2007	2.170	2.029	34.650	27.711	93	154.7	3.00	42.4	.03			
2518	1.320	1.639	34.671	27.759	114	161.2	2.90	40.9	.03			

Date: 1/25/77

Messenger Time: 1930

Bottom Depth: 4060 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

STATION NUMBER	Z (m)	T (°C)	FDT (°C)	S (°/sec)	SIGMA (%)	THETA (°)	1000 SIL (W/L)	1000 POL (W/L)	NO3 (MM/L)	PO2 (MM/L)	H2O
0	27.290	27.280	27.280	33.45E	21.490	20.2	• 3	• 27	• 3	0	• 30
25	27.060	27.054	27.054	33.44E	21.550	21.1	• 1	• 2E	• 2	• 02	
55	27.270	27.012	32.94E	21.379	20.2	• 1	• 2E	• 3	• 02	5.49	
75	26.460	26.422	34.22E	22.359	20.4	• 3	• 30	• 3	• 02	7.31	
100	17.560	17.843	34.507	25.622	• 0	14.3	2.1E	25.9	• 05	3E.73	
125	15.060	15.041	34.713	25.759	17	22.0	2.3E	26.4	• 07	47.69	
150	13.360	13.332	34.743	26.143	15	26.7	2.62			13.44	
175	12.390	12.36E	34.793	26.377	5	28.9	2.62	28.5	2.41	15.43	
200	11.750	11.724	34.741	26.491	2	30.9	2.6E	30.5	1.83	14.75	
224	11.2F0	11.231	34.746	26.555		33.1	2.67	29.9	1.54	14.94	
262	10.350	10.917	34.740	26.608	2	35.1	2.7E	28.4	2.33	9.24	
299	10.330	10.29L	34.639	26.696	3	37.7	2.91	30.2	1.74	7.94	
401	9.450	9.454	34.643	26.734	2	46.3	2.97	30.6	• 61	9.67	
438	7.960	7.869	34.593	26.997	•	60.6	3.19	33.4	• 6	6.68	
567	6.3F0	6.297	34.566	27.193	2	71.2	3.32	38.2	• 35	9.61	
911	5.540	5.463	34.560	27.293	15	89.2	3.45	45.9	• 02	29.74	
1004	4.350	4.469	34.567	27.414	12	106.6	3.51	49.6	• 01		
1492	2.350	2.381	34.612	27.609	5E	139.0	3.26	45.3	• 01	21.61	
2014	2.190	2.037	34.663	27.721	93	156.3	3.02	43.7	• 01	14.19	
2750	1.750	1.549	34.67F	27.770	126	163.4	2.92	40.9	• 02	16.40	

Date: 1/26/77

Messenger Time: 1704

Bottom Depth: 3330 m

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FROM COPY FURNISHED TO DDG

21

STATION NUMBER	T	Z	27T T	3	SIGMA	02	SIL	P04	N03	N02
(M)	(C)	(G)	(0/00)	THETA	-----	-----	-----	(UM/L)	-----	-----
0	27.520	27.520	33.450	21.403	210	.1	.28	.1	.01	.01
24	27.220	27.214	33.456	21.511	203	0	.26	0	.01	.01
49	27.150	27.156	33.624	21.657	209	0	.28	0	.01	.01
98	20.440	20.421	34.413	24.223	89	10.3	1.69	20.8	.07	.07
149	13.220	13.392	34.817	26.096	2	23.4	2.53	72.1	.03	.03
212	12.640	12.611	34.330	26.359	7	25.8	2.49	33.2	.03	.03
241			34.901		6	23.9	2.54	33.5	.03	.03
291	11.180	11.143	34.753	26.577	3	32.6	2.69	31.6	.70	.70
345	10.590	10.547	34.710	26.650	36.3	2.77	29.6			
389			34.658		3	43.0	2.94	29.7	.99	.99
514	3.430	3.374	34.604	26.577	3	55.4	3.14	32.0	.63	.63
601	7.170	7.110	34.565	27.092	4	67.3	3.28	38.1	.07	.07

Date: 1/27/77

Messenger Time: 1402

Bottom Depth 3180 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDC

(m)	STATION NUMBER	14	9 56.04			9 56.04		
			T	POT T	SIGMA	SIL	POT	HGT
			(C)	(C)	(C/00)	THETA	(C/L)	-
0	26.760	26.760	33.830	21.036	217			
50	17.840	17.831	34.713	25.113	84			
100	13.890	13.875	34.839	26.108	14			

Date: 1/29/77

Messenger Time: 1426

Bottom Depth: 3012 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDC

STATION NUMBER 15 (1)			7 46.4N			87 49.5W			
Z	T	POT T	S	SIGMA	02	SIL	P04	N03	N02
(m)	(°)	(C)	(U/001)	THETA	(UM/L)				
0	25.420	25.420	34.117	22.565	21.7	4.7	.81	7.5	.22
50	13.420	13.413	34.759	26.142	31	23.4	2.29	30.9	.17
100	12.250	12.237	34.789	26.399	45	26.5	2.38	32.5	.05
150	11.850	11.830	34.312	26.435	49	26.0	2.21	31.1	.03
200	11.630	11.604	34.818	26.542	41	26.9	2.26	32.4	.21
311	10.650	10.611	34.762	26.690	25	32.6	2.51	35.0	.03
349	10.110	10.36°	34.728	26.743	21	35.3	2.60	35.2	.03
399	9.520	9.573	34.709	26.917	7	40.9	2.80	35.7	.03
458	8.770	9.719	34.662	26.913	3	42.5	3.03	34.9	.05
498	7.980	7.928	34.627	27.013	3	56.7	3.18	34.4	1.13
555	7.210	7.155	34.613	27.114	6	63.1	3.21	41.1	.02
612	6.920	6.761	34.693	27.160	10	65.6	3.22	43.6	.02
818	5.440	5.362	34.576	27.318	30	94.4	3.28	45.5	.03
1004	4.540	4.452	34.586	27.430	36	101.6	3.28	45.3	.02

Date: 1/30/77

Messenger Time: 1837

Bottom Depth: 3329 m

THIS PAGE IS BEST QUALITY PRACTICABLE  
FROM COPY FURNISHED TO DDG

STATION NUMBER 15 (2)			7 46.3N 87 47.3W		
T	POT T	S	SIGMA	02	SIL
(W)	(C)	(0/00)	THETA		(W/L)
0	25.070				
50	14.100	14.093	34.0799	26.024	
100	12.670				
200	11.760				
398	9.580				
450	8.770				
516	7.360				
550	7.120				
604	6.860				
900	5.560	5.485	34.574	27.302	21
1011	4.510	4.427	34.578	27.427	35
1504	3.270	3.156	34.617	27.597	66
2000	2.260	2.117	34.652	27.706	25
2499	1.050	1.070	34.657	27.745	103
3000	1.030	1.033	34.665	27.756	110
3323			34.681		119
3325			34.674		117
				165.2	2.83
					39.2
					.02

Date: 1/31/77

Messenger Time: 1057

Bottom Depth: 330 m

Table 1. A Summary of Weather Conditions, Cruise WELOC-77-1

	Station															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15(1)	15(2)
Date (day in Jan. 77)	12	14	16	17	18	19	20	21	22	24	25	26	27	29	30	31
Hour (Messenger Time)	1345	1653	2016	0917	1634	1440	1320	1320	1316	0903	1930	1754	1452	1426	1837	1057
Barometer (mb)	1014.8	1015.6	1012.9	1014.8	1014.1	1012.4	1013.2	1012.5	1013.4	1012.0	1012.6	1009.1	1011.2	1010.2	1008.6	1011.0
Air Dry Temp. (°C)	13.4	16.8	25.2	25.1	20.6	24.5	26.0	28.5	28.5	26.8	27.3	28.1	27.2	28.3	26.0	26.6
Air Wet Temp. (°C)	12.2	13.5	22.1	22.4	20.3	22.9	23.1	25.2	25.0	24.1	24.2	26.1	23.1	24.0	24.4	25.3
Cloud Amount	4/10	0/10	10/10	10/10	10/10	10/10	10/10	8/10	10/10	5/10	4/10	2/10	4/10	5/10	7/10	
Visibility (Miles)	20	40	14	12	2	10	10	12	12	12	12	15	12	12	12	12
Wind Direction	230	330	345	030	000	080	105	070	060	065	010	115	060	025	020	
Wind Velocity (Kts)	24	10	22	10	5	2	18	24	12	14	10	12	4	12	13	
Wave Angle	10	4	8	0	5	2	0	13	5	2	0	2	12	0	4	2
Wave Direction	230	330	300	160	340	320	110	090	320	350	355	130	130	020	020	
Wave Height (ft.)	3	4	3	3	4	3	4	4	4	4	4	3	3	2	4	4
Wave Period (sec.)	5	7	10	8	7	7	8	7	7	7	7	8	8	4	9	